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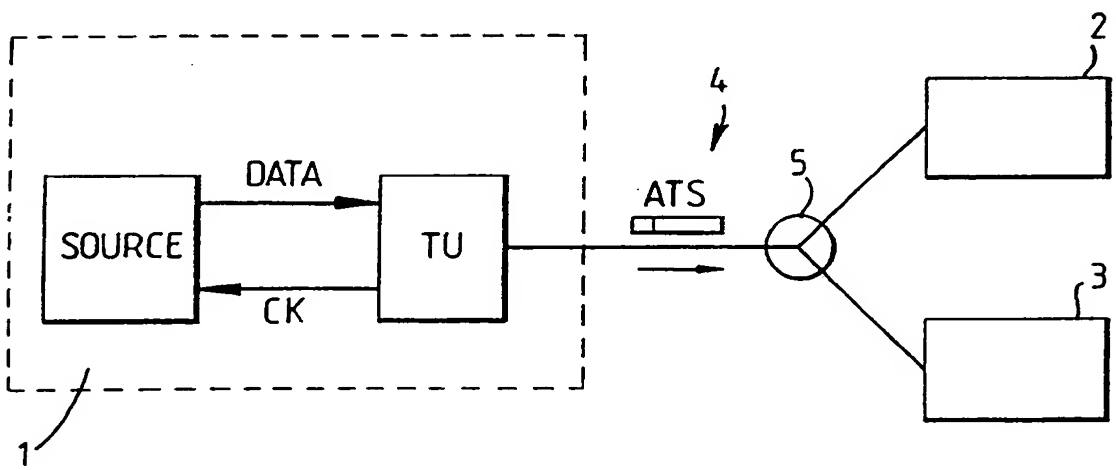

(57) Abstract

In a system for transmitting data cells from a transmitter (1) to a receiver (2, 3) each cell comprises a fixed format header containing address information and a free format time slice of predetermined duration. The cells may be transmitted on an optical network (4) in which case the cells are routed by an optical switch (5) which reads the header and is transparent to the free format time slice. Second level cells are formed comprising a second level header and a time slice filled with a number of first level cells.

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DATA TRANSMISSION ON OPTICAL NETWORKS

The present invention relates to the transmission of packets or cells of data on a network.

In most known cell based communication systems each cell is divided into a certain number of bytes forming a header which contains address and other system information, followed by a number of bytes or part-bytes in which a data source writes the information to be transmitted. Although the source is unconstrained as to the nature of the data it writes, the format used for writing the data has to match that used in the header. For example, the bit rate and line codes used in writing the data have to correspond to those used in the header. The format of the header in turn is necessarily fixed since it must be capable of being read at any node in the network.

According to the present invention in a system for transmitting data cells from a transmitter to a receiver via a network, each cell comprises a fixed format header containing at least address or routing information and a free format time slice of predetermined duration.

The present invention provides a cell based communication system which departs radically from the above known systems and offers many advantages. Instead of using cells of unitary format the present invention effectively decouples the formats of the header and the information bearing portions of each cell. The fixed format header is followed by or associated with a time slice which the data source is free to fill in any manner appropriate to the information being carried. Thus the time slice may be filled with a digital signal of any bit rate, with an analogue signal or just with a region of the optical spectrum containing, for example, a group of discrete wavelengths. The format, information rate, and meaning of the information field are limited only by the

requirements of the receiver and the system bandwidth. The flexibility of the system is such that, for example, a network user having the capability to transmit at a higher data rate than that used for the header is free to use that higher rate to put data onto the network, and can squeeze much more information into the cell than would be possible in a conventional system which limited the data rate to that of the header. The system offers savings in the cost of transmission equipment and pre-transmission equipment such as codecs.

A packet switching system is known from EP-A-0313389 in which high speed data packets are switched through an optical switch by means of a header comprising respective control wavelengths. In this case although the format of the data in the packet does not match that of the header, it will be understood that both formats are fixed (in the sense of the present invention) and the system is thus limited to handling data input in the same predetermined format, unlike the system of the present invention.

The system of the present invention which uses time slices with attached addresses has been termed by the inventor an addressed time slice (ATS) transport system.

Preferably the transmitter includes a data source arranged to fill the time slice with data for transmission and a transmission unit transparent to the time slice and arranged to attach the fixed format header to the time slice and to transmit the cell onto the network. The header may be attached in the sense of being associated with the time slice in a signalling channel.

Preferably the network includes routing means arranged to read information from the fixed format header and to route the cell accordingly, the routing means being transparent to the time slice.

Preferably the network is an optical network and the routing means is an optical switch arranged to read the header in the optical domain.

The system of the present invention may be used with wavelength division multiplexing (WDM). In this case preferably the ATS cell comprises a single wavelength header and a time slice including at least one channel at a different respective wavelength.

The system of the present invention may be extended by varying the size of the time slice at the different hierarchical levels of the network. In this case preferably a second level cell is formed comprising a second-level header containing at least second level address or routing information and a second level time slice comprising a plurality of first level ATS cells. This arrangement may allow a higher throughput where there would otherwise be a bottleneck at the routing stage.

A system in accordance with the present invention will now be described in detail with reference to the figures of the accompanying drawings in which:

Figure 1 is a diagram of a network;

Figure 2 is a diagram of an ATS cell;

Figure 3 is a diagram of a second level ATS cell; and

Figure 4 is a diagram of a network with local exchanges.

A data communication system comprises a transmitter 1 and receivers 2,3 linked to the transmitter 1 via an optical network 4. Although for clarity a simple network with a single branch and two receivers is shown, in practice the present invention is applicable to a wide range of network topologies and typically data will be routed to one or more of a large number of receivers. The network includes an optical switch 5 arranged to route data to a selected one of the receivers 2,3.

The transmitter 1 transmits data onto the network in addressed time slice (ATS) cells. The cell format shown in Figure 2 comprises a header 6 which carries header information in the form of address information only and a time slice 7. The time slice 7 which is of predetermined

duration but is otherwise of unfixed format is filled with data from the data source under control of a signal from a transmission unit TU which is transparent to the data from the data source. The data may, for example, take the form of an amplitude modulated analogue signal. To this signal filling the time slice 7 the transmission unit TU adds an address 5 which is of a fixed format for a given network. Although in the present example the header contains address information only, in general additional information may be included in the header when needed for a particular system. In the present example, the header is 4 bytes long and is encoded at a bit rate of substantially 155 Mbit/s. The ATS cell formed in this manner is transmitted onto the network and is received by the switch 5. The switch 5 reads the header and directs the cell to one of the receivers 2,3 accordingly. The data in the time slice is not read at the switch 5 and is transmitted intact.

At the receiver 2, 3 the header 5 is stripped off and the data in the time slice 6 decoded in a manner appropriate to the method of encoding used. In the present example, using analogue encoding, a simple photoelectric cell suffices to convert the encoded data to an electrical signal suitable for further processing as appropriate.

Figure 1B shows an alternative arrangement for the transmitter 1 in which separate sources are provided for the data and header information and the complete ATS cells assembled at the transmission unit TU.

The system may be extended hierarchically by forming higher level ATS cells comprising a header with address information appropriate to the particular level and a time slice filled with a number of lower level cells. Figure 3, for example, shows a second level cell formed by a header containing a second level address and a time slice filled with three first level cells.

In Figure 4, when an ATS terminal T (comprising a

transmitter 1 and a receiver 2) wants to make a call it sends a first cell to a local exchange LE (sometimes referred to as a head-end) intermediate the terminal T and the main network 4. This cell contains the information necessary for the local exchange LE to set up the call, and is sent at a basic data rate of 34 Mbit/s. Part of the information in this first cell declares the data rate that the terminal will use for further headers (either for the call duration or for all future calls). The local exchange LE will regenerate the headers at a network header rate of 565 Mbit/s for onward transmission on the network 4. If the destination terminal T does not operate at this header rate then the remote local exchange LE will convert down to the required rate. Thus smooth network evolution is possible, slow terminals can function at the basic rate, and the network header rate can be changed without affecting the terminals.

Terminals can be arranged to respond to a polling cell issued by a local exchange by returning a cell at basic data rate, even though such a terminal is designed for high speed normal transmission of data. In this way the local exchange can process all returning cells at the known basic data rate regardless of the normal operating rate of a terminal which can be one of a number of data rates.

Whereas in the above described system the header information is in the form of address information, it will be appreciated that it can alternatively be in the form of routing information. Furthermore, the header information may include some control information which may comprise a 1 bit flag to indicate whether the time slice needs to be treated transparently. Instead of the header including such an indication, the first cell can contain a field, which again may be a single bit, to indicate this requirement.

Whereas in the described system the header is attached to the front of the data in the time slice in

the same transmission channel (wavelength), the header may be provided ("attached") at a wavelength different from that of the data of the time slice. This enables a plurality of cells to share the same time slice with their headers on a common signalling channel, and there can be a respective signalling channel for different signalling rates, e.g. 34 Mbit/s, 140 Mbit/s or 565 Mbit/s.

An advantage of using a common channel for the headers is that the system can handle ATM (asynchronous transfer mode) packets and copy the ATM header into the common channel.

CLAIMS

1. A system for transmitting data cells from a transmitter to a receiver via a network, in which each cell comprises a fixed format header containing at least address or routing information and a free format time slice of predetermined duration.

2. A system according to claim 1, in which the transmitter includes a data source arranged to fill the time slice with data for transmission and a transmission unit transparent to the time slice and arranged to attach the fixed format header to the time slice and to transmit the cell onto the network.

3. A system according to claim 1 or 2, in which the network includes routing means arranged to read information from the fixed format header and to route the cell accordingly, the routing means being transparent to the time slice.

4. A system according to claim 3, in which the network is an optical network and the routing means is an optical switch arranged to read the header in the optical domain.

5. A system according to claim 4, in which the cell comprises a single wavelength header and a time slice including at least one channel at a different respective wavelength.

6. A system according to claim 4, in which the cell comprises a plural wavelength header and a time slice including at least one channel at a different respective wavelength.

7. A system according to claim 5 or claim 6, in which a plurality of cells share the same time slice with their headers multiplexed on the single wavelength or on the plurality of wavelengths, as the case may be.

8. A system according to any one of the preceding claims, in which first level cells are formed, the fixed format headers of the first level cells containing at

least first level address or routing information, and in which a second level cell is formed comprising a second level header containing at least second level address or routing information and a second level time slice comprising a plurality of first level cells.

Fig.1A

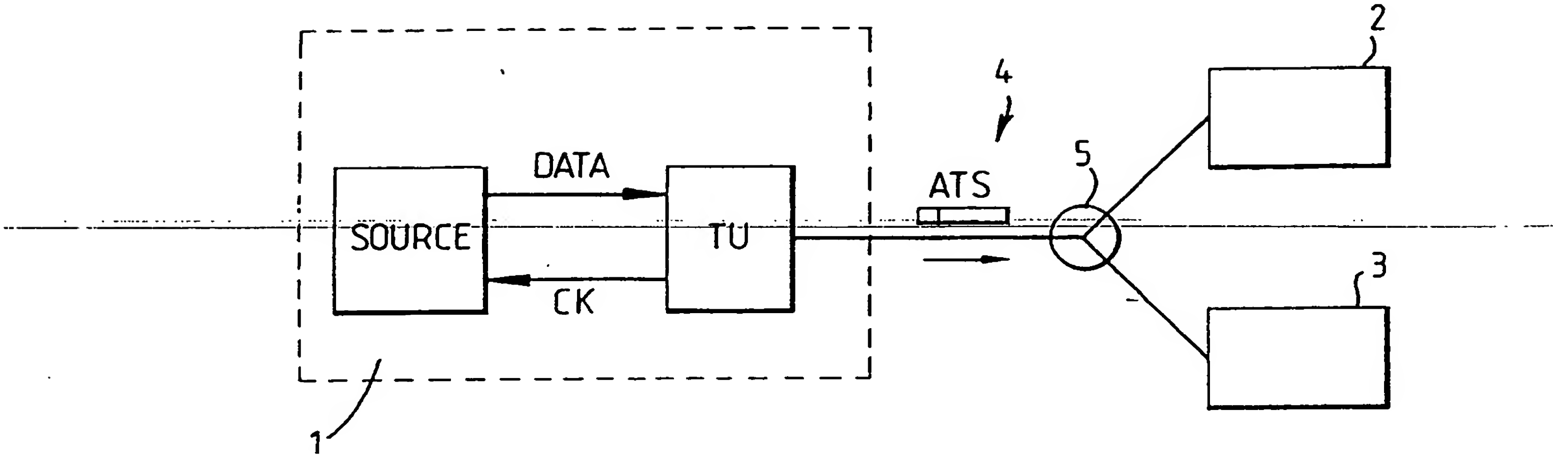


Fig. 1B

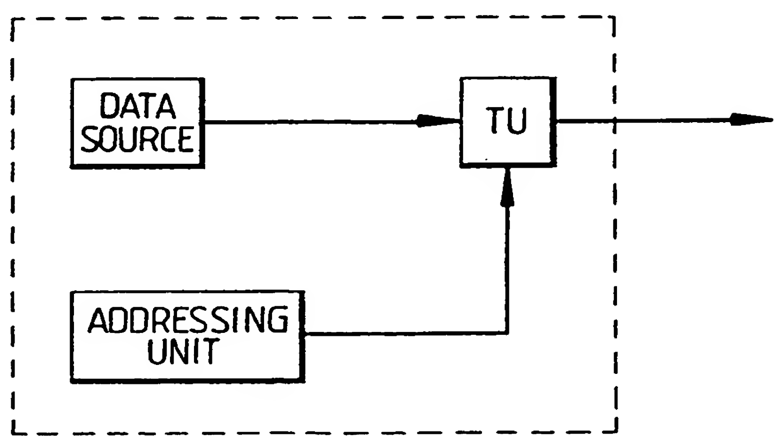


Fig. 2.

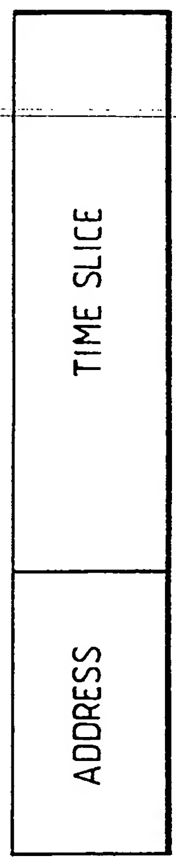
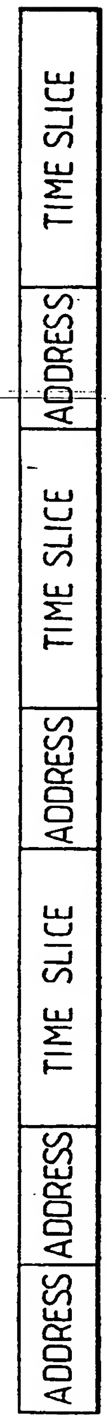
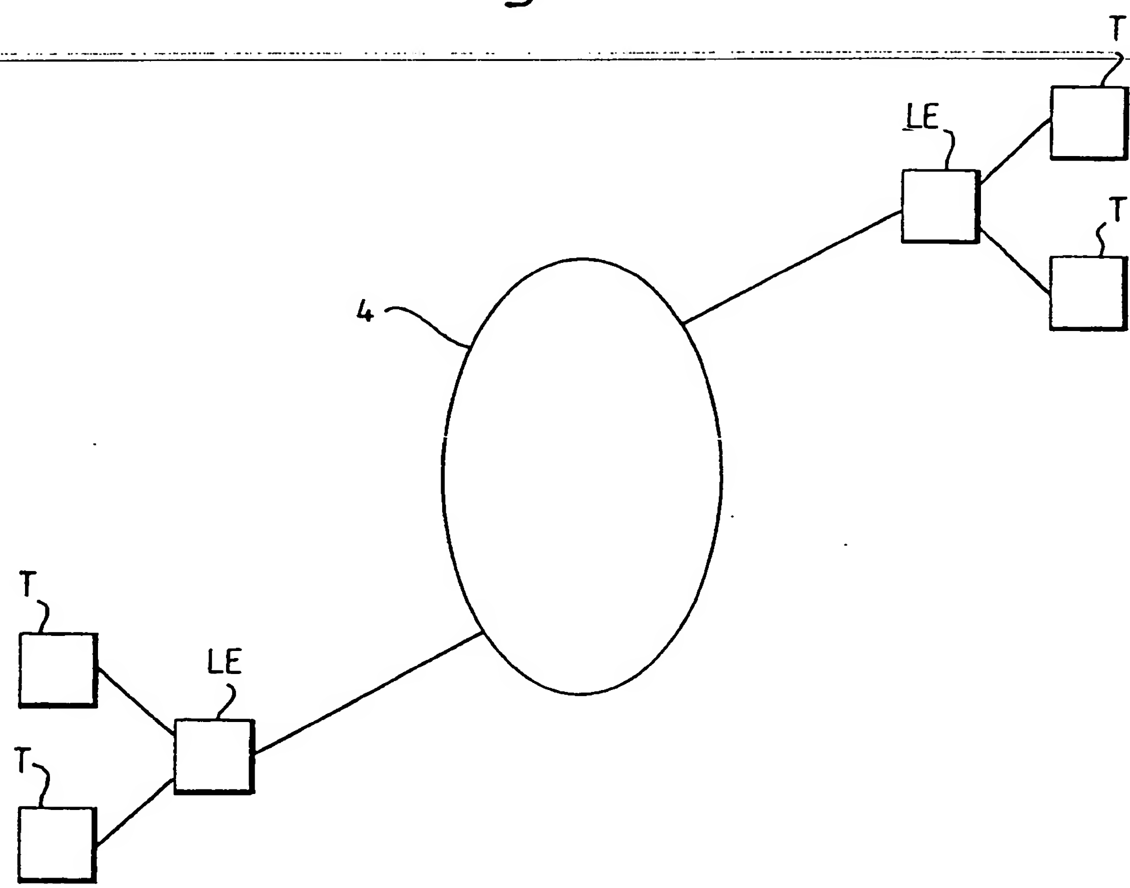


Fig. 3.



SUBSTITUTE SHEET

Fig. 4.



SUBSTITUTE SHEET

INTERNATIONAL SEARCH REPORT

International Application No PCT/GB 90/01129

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [6]

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC^5: H 04 J 14/08, H 04 J 3/24, H 04 J 14/02

II. FIELDS SEARCHED

Minimum Documentation Searched [7]

Classification System	Classification Symbols
IPC^5	H 04 J, H 04 Q

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

Category *	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No. [13]
Y	DE, A, 3211966 (SIEMENS) 13 October 1983 see page 7, lines 14-29; page 8, lines 15-21; page 9, lines 1-9; page 10, line 5 - page 11, line 21; page 14, lines 9-25; page 16, line 9 - page 17, line 18; page 23, line 18 - page 24, line 12 --	2,4,6-8
Y	Journal of Lightwave Technology, volume LT-3, no. 3, June 1985, IEEE, (New York, US), T. Hermes et al.: "LOCNET - A local area network using optical switching", pages 467-471 see page 467, right-hand column, paragraph C; page 468, left-hand column, paragraph E; page 469, right-hand column, lines 18-24 --	1,3
Y	EP, A, 0313389 (KOKUSAI DENSHIN DENWA KABUSHIKI) 26 April 1989 see page 3, lines 29-44,53-55; page 6, lines 39-45,52-57 ./.	1-8

* Special categories of cited documents: [10]

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IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
25th October 1990	22. 11. 90
International Searching Authority	**Signature of Authorized Officer**
EUROPEAN PATENT OFFICE	M. Peis M. PEIS

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III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)

Category *	Citation of Document, [11] with indication, where appropriate, of the relevant passages	Relevant to Claim No.
	cited in the application --	
Y	EP, A, 0295857 (BRITISH TELECOMMUNICATIONS PLC) 21 December 1988 see page 2, lines 17-36; page 3, line 41 - page 4, line 7; page 5, lines 49-53 --	5
Y	IBM Technical Disclosure Bulletin, volume 32, no. 4B, September 1989, (Armonk, N.Y. US), "Passive optical star with a tunable receiver for hybrid access control and overflow prevention", pages 331-337 see page 333, line 33 - page 334, line 7 ----------	7

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO. GB 9001129 SA 38778

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE-A- 3211966	13-10-83	DE-A- 3221943	15-12-83
EP-A- 0313389	26-04-89	JP-A- 1108831	26-04-89
		US-A- 4894818	16-01-90
EP-A- 0295857	21-12-88	AU-A- 1801988	04-01-89
		WO-A- 8810037	15-12-88
		JP-T- 2500712	08-03-90

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